BOUNDARY CROSSING PROBLEMS IN INSURANCE

By

Renata Sidorowicz

SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE IN MATHEMATICAL SCIENCES
AT
UNIVERSITY OF TECHNOLOGY, SYDNEY
SYDNEY, AUSTRALIA
JUN 2006

UNIVERSITY OF TECHNOLOGY, SYDNEY

CERTIFICATE OF AUTHORSHIP/ORGINALITY

Date: **Jun 2006**

Author: **Renata Sidorowicz**

Title: **Boundary Crossing Problems in Insurance**

Department: **Mathematical Sciences**

Degree: **M.Sc.** Convocation: **Mar** Year: **2005**

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirenments for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Sidorowicz

Signature of Author

ACKNOWLEDGMENTS

There are many people I would like to acknowledge for their support, both technical and emotional, during my MSc studies. I list but a few here.

I would like to thank Professor Alexander Novikov, my supervisor, for providing opportunity to take up a MSc and for continuing advice and enthusiasm throughout the research.

My thanks go to the staff and students of the Mathematical Science Department for their support and for friendly atmosphere. On the financial note, I wish to express my gratitude to my supervisor Professor Alexander Novikov and also Professor Eckhard Platen. Further, I would like to thank Dale Roberts for his editorial assistance.

Finally to my friends, my family and to Lubos, thank you all for being there.

Table of Contents

List of Tables

List of Figures

Abstract

In the actuarial sense, a risk process models a surplus of an insurance company. The company is allowed to invest money with a constant interest rate. Some generalizations of the constant interest rate models are also considered. Ruin is defined to have occurred when the risk process reaches some certain level, which is less than the initial capital. In particular the level is assumed to be zero.

Papers such as Harrison [17], Schmidli [37] and Embrechts & Schmidli [11] consider similar models with constant interest rate and obtain explicit solutions as well as diffusion approximations for the probability of ruin in infinite time. Our main approach is to use Martingale techniques in order to obtain exact solutions for probabilities of ruin in the finite time horizon which are further compared with numerical simulations. Furthermore, we analyse models with more general interest rate and propose a series of methods which can be used in order to determine the finite time ruin probabilities.